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ABSTRACT

The work of English cybernetician Gordon Pask on learning styles and strategies is presented. An attempt is made to describe the basic ideas of Conversation Theory, Pask's general theory of cognition. The learning strategies "holism" and "serialism," and the more general learning styles "comprehension learning" and "operation learning" are derived from Conversation Theory. These strategies and styles are described, both operationally and in terms of constructs within the theory. It is argued that the theory, apart from generating hypotheses about learning and teaching, may function as an analytic tool in the study of educational practice. (Author/LC)

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# LEARNING STYLES AND LEARNING STRATEGIES

## I. Conversation theory - The work of Gordon Pask

Berner Lindström

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## ABSTRACT

The paper presents the work of the English cybernetican Gordon Pask on learning styles and strategies. Pask offers a general theory of cognition, "Conversation Theory" and an attempt is made to describe the basic ideas of this theory. It is argued that the theory, apart from generating hypotheses about learning and teaching, may function as an analytic tool in the study of educational practice. From Conversation Theory the learning strategies, "holism" and "serialism", and the more general learning styles, "comprehension learning" and "operation learning", are derived. These strategies and styles are described, both operationally and in terms of constructs within the theory.

## 1 Introduction

In the study of human cognition there ha been an increasing interest in the styles and strategies people adopt in, for example, learning and problem solving. There are several reasons, I think, for this interest.

Terms like style and strategy imply a focus on typical ´modes´ of behaviour and activity which are akin to ou. common-sense conceptualizations. That is, when looking at peoples behaviour we often tend to characterize their typical way of acting, may it be in the intellectual, social or physical sphere etc. Sometimes this is a conceptualization in terms of people (what is commonly understood as a ´typology´), and sometimes in terms of peoples´ behaviour and activities. This tendency realizes itself in every-day human life and within science and is part of a basic drive in our society towards a conceptual reduction (abstraction) of reality in a few inclusive categories.

There are also reasons emerging within the different fields of inquiry. In cognitive psychology a chief occupation has been with identifying and describing cognitive processes on a microscopic level. In research on human intelligence, for example, the "componential" approach (Sternberg, 1977) has a prominent place. Studies of spatial ability (cf Shepard & Metzler, 1971; Cooper and Regan, 1982; Egan, 1979) and verbal ability and learning (cf Hunt, 1978; Clark & Chase, 1972) provide other examples. Much of this work is basically carried out within the human information processing tradition. Provided it is accepted that it is possible to characterize much of this research as particularistic, the problem is, as Rigney (1980) puts it, "to put the pieces together". Rigney continues:

> "Although there is a widespread reluctance to face it, it is being adressed by som information-processing theorists, who recognize that the elements of the new mental chemistry - which we now call cognitive primitives or basic processing operations or schemata - must somehow be organized and controlled" (ibid, p 315).

Apart from Rigneys own proposals of cognitive learning or process strategies, Sternbergs (1980) notion of ´metacomponents´ provides an example. One ´empirical´ reason for this is that the magnitude of relationships between basic information-processing operations and, for example, psychometric

measures of abilities appears to be small. Generally they are around .30 (cf Cooper & Regan, 1982).

The urge for higher order constructs may then, at least in part, be seen as a consequence of the low explanatory value of basic processes or operations. This brings to the fore other circumstances of importance. One factor is that cognitive psychologists ordinarily study general psychological mechanisms, while disregarding individual differences. On the other hand, the mainstream of contemporary research in individual differences in the cognitive realm aims at describing individual differences in terms of basic cognitive processes or operations. The mere focus on individual differences is probably one important factor, especially when regarding the rather low explanatory value of basic information-processing constructs.

But the shortcomings of particularistic theories in this narrow context are perhaps not as important as the shortcomings of these theories to apply to human conduct in real-life settings, for example within education. This is not to say that operation constructs are not valid in their own right. The point is just that they seem to contribute little to the understanding and explanation of human every-day efforts to cope with the environment (cf Federico, 1980; Neisser, 1976).

Many ideas are advanced to meet with this problem. Broudy (1977), for example, suggested "contextual knowledge" or "knowing with" as a focus. This implies that we should be more concerned with the fact that the meaning individuals give to the world they meet is highly dependent upon their internal frames of reference. Anderson (1977) argued that the notion of "schema" adopted in much current research is a solution. But he also emphasized that schemas must take on a holistic character, being more than the constituent parts. These ideas also put the content of the individuals' knowing into focus.

This stress for a more 'holistic' view of humans is also evident in research on 'cognitive styles', which, for the most part, has focused on the interface between intelligence and personality. Kogan (1980) suggested that the lack of interest for personality among researchers in

human intelligence was one of the driving forces for cognitive-style constructs to emerge. He also proposed another explanatory factor, namely that: "abilities and aptitudes as traditionally conceived are concerned almost exclusively with accuracy and efficiency, and hence new constructs were needed to account for the range of cognitive performances where form and manner, rather than sheer skill of performance, are at issue" (ibid, p 248).

> "Cognitive styles can be most directly defined as individual variation in modes of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming, and utilizing information. It may be noted that abilities also involve the foregoing properties, but a difference in emphasis should be noted: Abilities concern level of skill - the more and less of performance - whereas cognitive style give greater weight to the manner and form of cognition" (Kogan, 1971, p 244; emphasis in original).

It is important to note that cognitive-styles are concerned with the 'how' or 'quality' (in a descriptive sense) of human conduct. But it is also important to note the status of such constructs in relation to other psychological constructs. Messick (1976, p 9) argues that cognitive styles "appear to serve as high-level heuristics that organize lower-level strategies, operations, and propensities - often including abilities - in such complex sequential processes as problem solving and learning".

There are many suggestions of cognitive-styles. Messick (1976) has summarized research on cognitive-style and counted to at least 19 different styles. Probably the best-known is field dependence versus field independence (cf Witkin et al, 1977).

It has been argued above that conceptions of stylistic and strategic dimensions of human psychological functioning are concerned with the 'how' rather than 'how well'. This may indicate that it doesn't matter what style or strategy an individual adopts. This is wrong. Style or strategy does matter, but not in an 'absolute' way. Rather, the functional value of a style or strategy is dependent upon the context or situation it is adopted in and upon subordinate psychologicall skills -- it matters in a 'relative' sense. Thus, for example, Witkin et al (1977) relates work on field dependence - field dependence indicating that there are interactions between an individuals style and instruction, both with regard to learning and how

teachers and pupils appreciate each other. To provide another example, Bruner (1956) discusses the functional value of different problem solving strategies with respect to the burdens they put on memory.

I think this turns out to be a major point. Conceptualizations in terms of styles and strategies do not only (possibly) enable us to 'put the pieces toghether'. It also give us a starting point for a more fruitful discussion of what aspects of the environment are important with respect to human learning and problem solving. This may ultimately give us a firmer basis for adapting instruction to individual needs and demands (cf Federico, 1980; Snow, 1980).

The rest of this paper will be concerned with the work of the English cybernetician Gordon Pask. There are two main reasons for this. First, the empirical work of Pask and his collegues (cf Pask, 1975b; Pask & Scott, 1972) demonstrates interaction effects between strategy of learning adopted and strategy of teaching used of such a magnitude, that a closer examination seems warranted. Secondly, and more important, Pasks theoretical work (cf Pask, 1975a, 1975b, 1976, 1979) provides a framework for research on learning and instruction (teaching), with possibilities of describing learning and instruction in 'compatible' terms. This theoretical work has developed into a theory -- "Conversation Theory" -- in which Pask's work on learning styles and strategies is anchored.

The presentation is mainly descriptive. The intention is to present some of the fundamentals of Conversations Theory and related work on learning strategies and learning styles. To some this description will seem too simple-minded and this may be true, expecially for those familiar with cognitive science. But the idea is to provide the educational researcher with a conceptual skeleton for a proper understanding of Pask's work on learning and teaching. This skeleton may also function as an "advance organizer" for the study of Pask's own writings. The approach chosen is thus not "analytic". There is no systematic discussion of how Pask's work relate to other cognitive theories. Attempts of this kind has been done by others, especially with regard to Pask's suggestions of styles and strategies (see Laurillard, 1978; Marton, 1982a, 1982b).

## 2 Conversation Theory

An attempt to understand the ideas of Pask presents great difficulties. This is an assertion made by many of the researchers who have made such attempts (cf Daniels, 1976; Entwistle, 1978; Ogden, 1981). There are many reasons for these difficulties. The scope of Pask´s work is very wide. It covers many fields of inquiry; epistemology, cybernetics, system theory, learning and teaching, just to mention some. Another problem is the great richness of discussions of subtle details. Such difficulties may, however, be attributed to the limited frame of reference you may have as an educational researcher. Another kind of problem is offered by Pask´s style of writing. Most often his writings are very abstract and furthermore he is using a (private?) symbolic lanquage to express his ideas. Still more important is probably that Pask´s ideas include reconceptualizations of old terms, which means that certain basics may not be taken for granted.

Despite these difficulties there are several reasons for accepting the challenge. One reason is that it is necessary to have some understanding of the underlying theory to understand Pask´s work on learning and teaching. Another reason is that it offers a novel framework for theorizing about learning and teaching containing several different elements. Here it is possible to agree with Ogdens (1981) suggestion that "This framework intermingles elements of at least three kinds: a ´theory´ of cognition, an ´epistemology´ of experimentation, and ´heuristics´ for planning experiments and teaching/learning systems or situations" (ibid, p 1).

## 2.1 Outline of the fundamentals of the theory.

Conversation Theory is a cybernetic or systemic theory. It is concerned with "how systems regulate themselves, reproduce themselves, evolve and learn" (Pask, 1961, p 11) - how a system must be constructed in order to be able to learn. The cybernetic perspective also implies that it is a general theory. It extends traditional scientific disciplines such as psychology, sociology or biology. More precisely, Conversation Theory is a theory of general cognition. This means that it is a theory of cognition which not a priory is confined to a specific biological, mechanical or social reality.

Conversation Theory is a normative theory. It postulates that cognition and, more specifically, learning is goal-directed. A goal must not here be understood as an end-state, but rather a an intention (cf von Wright, 1971). There are two aspects of the theory that explicate this. In the first place, Conversation Theory deals with (actually or potentially) counscious events. Consciousness is regarded as a specific phenomenon: "Somebody is conscious with somebody else of something". Somebody is in this context not a person, but a cognitive system. Consciousness (or more broadly, awareness) is in turn closely related to the problem of attention. In a sense the theory is deeply concerned with this problem, defining the field of attention as the scope of awareness. Attention may then be viewed as the locus of awareness. There is also a focus of attention or an aim as a necessary prerequisite for a cognitive activity. Counsciousness, then, is the appreciation of the aim (or aim topic).

Conversation Theory stipulates a conversation as the basic unit (of observation). A conversation takes place between participants. Participants are cognitive systems able to learn and solve problems. How then is such a system constructed?

To describe this it is possible to start from figure 1 below (the figure is, with slight modifications, taken from Pask (1975, p 46).

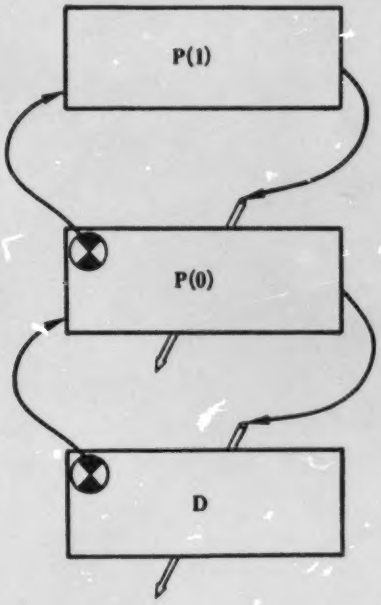


Figure 1. The structure of a problem solving system.

The system operates upon a domain. In the figure the shorthand notation D is used for such a domain, which here may be characterized as a problem domain. A domain is a collection of topics, and a topic is essentially a relation. This may be a very concrete relation (a relation between alphabetic characters and the keyboard positions in typewriting) or it may be an abstract relation (a relation between smugglers and the countries they operate in). To learn or solve a problem is to 'bring about' such a topic relation.

P(0) in the middle box stands for procedures which operate upon the domain in order to bring about or explain topic relations. (The symbol // designates such an operation.) The procedures may be of any complexity. There must also be feed-back from the domain, that is the procedures are supplied with a description (the symbol ⊗ ) of the effects of their operation. This part of the system may be illustrated with a heating system regulated by a thermostate. Such systems are, however, limited in only beeing able to

account for forseen events -- it can not 'learn'. To extend the previous example, only certain ranges of temperature are accounted for.

P(1) in the upper box stands for higher-level procedures. These higher-level procedures operate on lower-level procedures to construct and reconstruct them. Also P(1)-procedures are fed back with a description of the results of their operations. An individual solving a problem (level P(0)) and at the same time looking at how he performs (level P(1)) and changing the way of performing if he is not successful is an example. Another example is the development of computer programs. Level P(0) may be likened with the program and level P(1) with the programmer developing and improving the program.

An important feature of such a system is that it is self-reproductive. This idea is crucial. What this ends up to is that there is no assumption of any fixed storage of procedures. The cognitive system preserves itself by telling itself what it looks like, it constructs and reconstructs itself. To understand this it is important to realize that the theory is concerned with cognitive systems in general and not with specific ones realized for example in a human brain or a computer. The units to think in are functions (procedures) or functional loci. The theory is not concerned with the localizations of procedures or functions, even if it does not exclude that functions (procedures) may be mechanically localized. This idea of Pask is close to the ideas of human neuropsychological organization proposed by Luria (1966).

The term procedure as used by Pask has two components, a 'program' and a 'compilation'. A program must not be understood as an algorithm but rather as a 'heuristic'. What is more important than this, however, is the second part. A compilation is a recognition that a program must be executed in some kind of context (a computer, a human brain etc) and that procedures may be different depending on context. (A compiler translates a program written in a certain language into a code suitable for a specific computer.)

Pask also uses the terms 'concept' and 'memory' to describe the system. A concept is not equivalent to a class of objects or a description of a class, but is defined as a set of procedures that brings about a topic relation. A

concept is thus constructed and reconstructed. A concept is thus a set of programs and compilations. These compilations must be stable or autonomous, there must be no incompatibilities upon execution, incompatibilities demanding information for their resolution. This idea of concept comes close to Bartlett's (1932) idea of schema. A memory is the stable compilations of concepts. Memory is thus not a 'storage', as in conventional computer terminology, but a process.

A system with the basic features outlined above may 'think' or 'solve problems' but in order to learn it will not do. A system able to learn is sketched in figure 2 below.

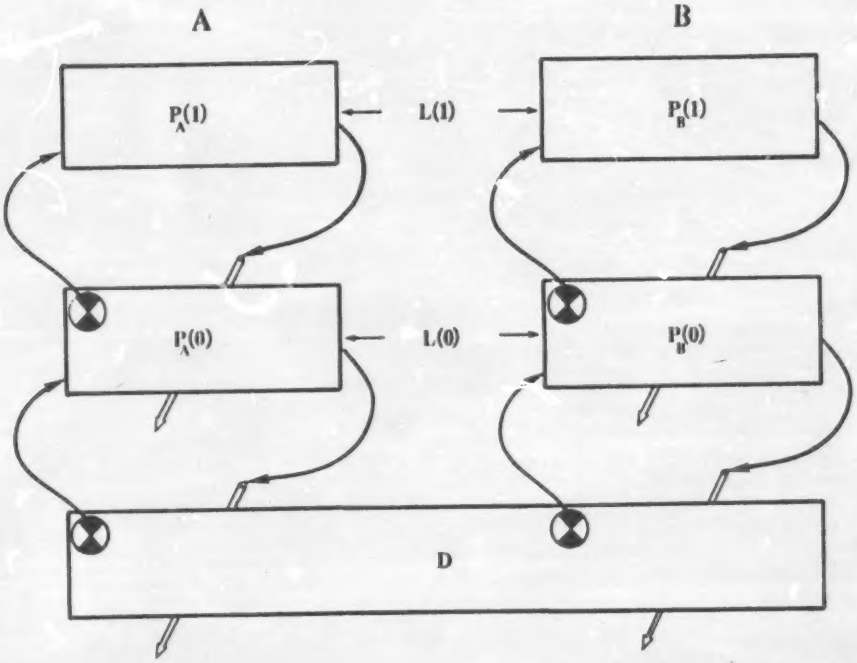


Figure 2. The minimal structure of a problem solving/learning conversative system.

This system is stratified in two levels. It has procedures operating upon the same domain. The crux of the matter is that there must be connections or couplings between the set of procedures within each level (or at least the lower one). These connections enable the dialogue or conversation necessary for learning. Learning can, for short, be defined as the generation of new concepts and memories (out of old ones).

Describing Pask's basic construction of a conversation in this way can only give a brief idea. Pask's system is totally relativistic and in this context it must be recognized that the participants (A and B in figure 2) in their turn have the basic construction of figure 2. This may occasionally make you feel as if your mind is twisted around, but trying to grasp the idea is important. For one thing, it seems as if this kind of relativistic theory may in the long run enable you to link phenomena on different levels together.

The conversation between participants, as described above, is the basic unit. It is by observing ongoing conversations that we may draw out normaly hidden cognitive events. Conversation takes place within a language L. L may be a natural, written or spoken, symbolic language, but it need not be. It may be a system of symbolic behaviours such as dance or actions such as key pressing. It may be formalized, as in mathematics och higher-level programming languages, but it need not be. It must however have many of the qualities of a natural language, with possibilities to express and interpret commands, questions, answers, obediences, explanations or descriptions (cf Pask, 1979, p 3). It must be a programming language as well as a descriptiv language.

What is observed in a conversation are transactions between the participants couched in the language L. It is these transactions that may be observed and described and which for Pask count as 'hard valued observations'. But for this to work there are several other requirements.

It is obvious that in order to converse about something there must be an agreement over what to converse about (the domain). This is expressed in the fact that the participants are tied to the same domain. Furthermore there must be an agreement over which language L to use. In other words the participants must subscribe to use a certain language.

The notion of agreement can be qualified further. Suppose that A gives B a description of how he carries out a certain operation (for example how to subtract one figure from another or what to do to subtract one figure from another). This is somewhat like giving away a list of a source code for a

program. Pask calls this an instance of 'explanation'. B then carries out these operations, and if he reaches the same result (satisfies the same topic relation) it is said that A and B has the same concept. This agreement exists on the lower level. In figure 3 below the description on this level is shown by D(0).

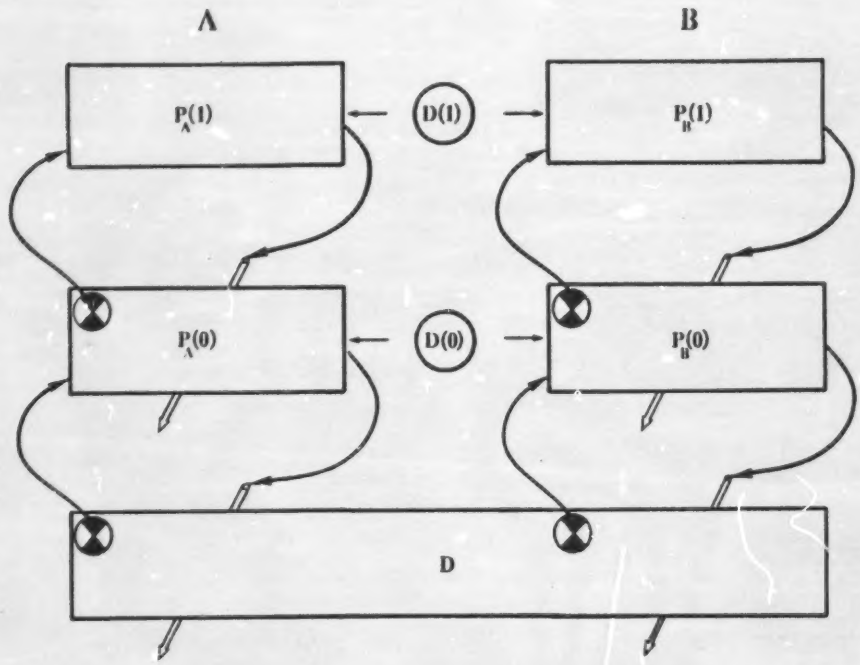


Figure 3. A general model of the structure of a problem solving/learning conversative system.

But does B understand A? In Pask's view agreement over a concept does not guarantee understanding. This also requires a derivation, i.e. B must also describe why he carries out the operations he has proposed on the lower level. In figure 3 this description is shown by D(1). To extend the first example given above, A must tell B why to subtract in the way he proposed. To extend the second example above, the programmer must tell why the source code is written in a certain way. From this the source code may be reconstructed if necessary (perhaps with the use of other subroutines or subprocedures). If B in turn can construct the operations on the lower level from the description he has received there is an agreement over an understanding. And if this is the case the conversation is called a strict conversation.

## 2.2 Methodology

Conversation Theory also offers a methodology for research on learning and teaching. Pask´s proposal is that it is not possible to study directly what is in peoples´ minds, procedures are not accessible for direct study. It is however possible to study the conversation that takes place by means of introducing ´interfaces´ at different levels. Thus, what is normaly hidden may be "exteriorized". This is illustrated by extending figure 3 into figure 4.

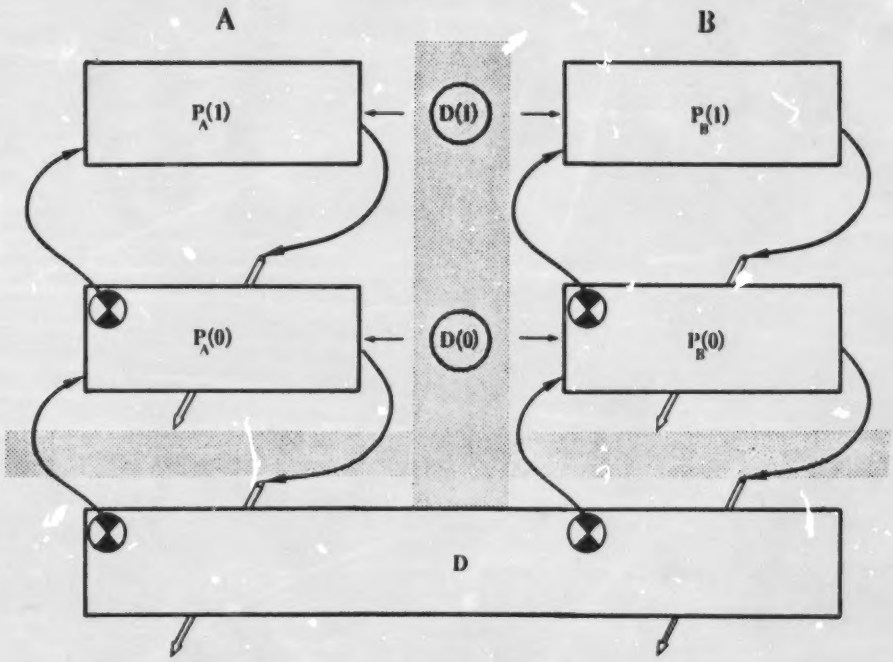


Figure 4. Interfaces for observation in a conversative system.

Here there is a vertical interface between the participants. In this interface D(0) and D(1) are embodied. These correspond in Pask´s terminology to the task structure and the entailment structure, respectively. The task structure represents all possible ways to explain a topic relation, i.e. how to build a model of a topic relation in some environment. The entailment structure represents what may be learned and how it legally may be learned. This construction is to be likened with a ´topic map´, describing both a

hierarchy of topics and possible analogies to be made. A rough sketch is given in figure 5 below. Generally, this ´vertical interface´ accounts for the fact that there must be some kind of communication medium and that the conversation taking place through that medium can be recorded. The medium may simply be air, and tape recordings can be made by use of a tape recorder. This general idea is simple, but there is one important point to note. This amounts to the fact that the interface is divided into two levels, with a demand for both explanations and derivations, the ´how´ and ´why´ in the conversation.

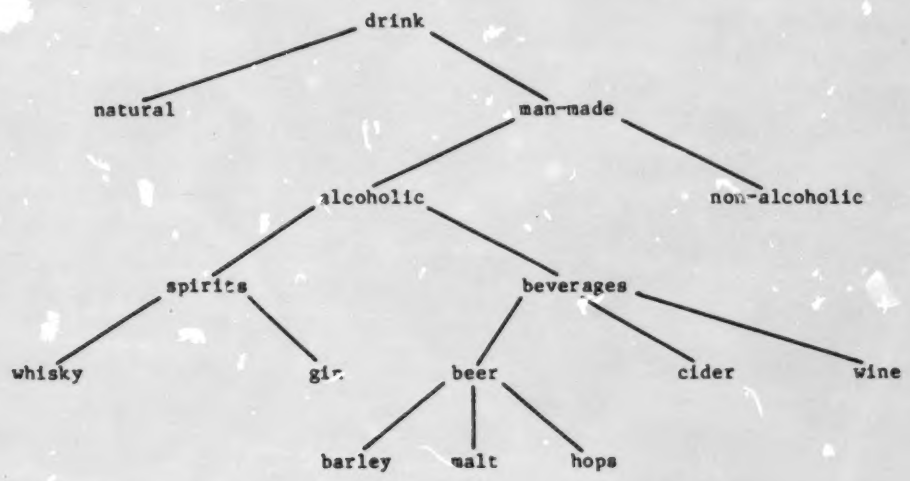


Figure 5. Entailment structure for "drink".
(Taken from Wilson, 1980.)

Through the horizontal interface it is possible to take part of ´what´ is conversed about, the content. This is embodied in the conversational domain and may, for example, be a concrete material in the form of a text or a problem puzzle (as used in a Piagetian experiment).

The methodology outlined above has a close resemblance to the clinical interview as a research method, as used for example in the Piagetian and Sovjet Interactionist Schools. Both ´what´ and ´why´ questions are posed, and furthermore the studies are most often centered around a concrete material in which experiments and demonstrations can be made.

In characterizing the fundamentals of Conversation Theory above it was emphasized that it is a system in abstracto rather than a system tied to a certain reality. This can not be emphasized to strongly, and is probably one of the most intriguing aspects of Pask´s work, Cognitive processes are not confined to human brains, even if they may occur in human brains. Cognition may also occur in groups of people, in a culture, and it may characterize the function of a computer. Thus, when applying the theory to problems in learning and teaching a participant is not a priori defined as a human subject. This may be the case but a participant may also be a computer, a group of people, or parts of a human brain. This is illustrated in figure 6 below (In the figure physical entities are shown as rectangles and a participant is shown as an outline). A participant should instead be thought of as ´perspectives´ or "coherent systems of hypotheses, beliefs, or generally concepts" (Pask. 1979, p 5). Even so, there are also within the theory possibilities to account for certain restricting features of the ´processors´, in which the ´programs´ are run. Pask himself discusses this, especially with regard to his empirical work on learning styles and strategies.

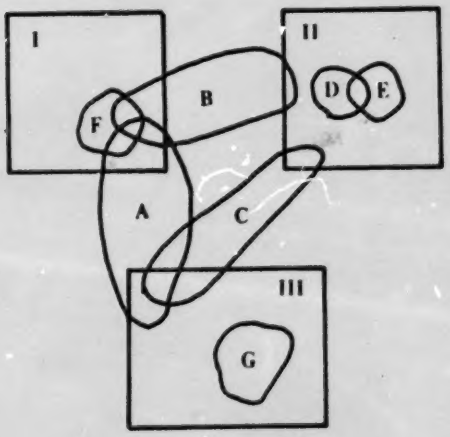


Figure 6. Relationships between participants and processors.

## 3 Learning strategies and learning styles.

In Pask´s work it is his account of learning strategies and learning styles that have gained most interest (cf Entwistle, 1978, 1981; Wilson, 1981). In some earlier work (Pask and Scott, 1972; Pask, 1975a; 1975b) he identified two major strategies of learning "serialism" and "holism", and also demonstrated that the learning strategy adopted by a student interacted with the teaching strategy used in instruction. In later work he has also described more general aspects of subjects´ learning or learning style. Two major aspects are identified, "comprehension learning" and "operation learning" (cf Pask, 1976; Pask, 1979). In the following, Pask´s work on learning strategies will be described. After this his account of learning styles will be described. The discussion of the relation between styles and strategies (and the defintion of these constructs) is taken up after a more concrete account of Pask´s work has been given.

### 3.1 Serialist and holist strategies.

Pask and Scott (1972) and Pask (1975b) described a set of experiments demonstrating the strategies used by subjects in learning fictive taxonomies. In some of these experiments a conversational technique called "monitored free learning" followed by "teach-back" was used. What this amounts to is a relaxation of the strict conversation paradigm outlined above, for example by not demanding understanding.

In the taxonomy experiment subjects are required to learn the classificatory principles involved in a fictive taxonomy of some imaginary species of Martian animals, the Clobbits. In figure 7 below this taxonomy is shown. Information about this taxonomy is given on cards, that are faced downwards and ordered in five columns. Each column contains one ´class´ of data (pictures of animals, contextual information about appearance and habitat, number of tests to distinguish a subspecies, physical characteristics, and

names of subspecies). As a complement to the cards given the student may also invent his own cards by writing down notes. An important aspect of this material is that it is redundant, i.e. you don't need information of all 'classes' to establish the classificatory principles.

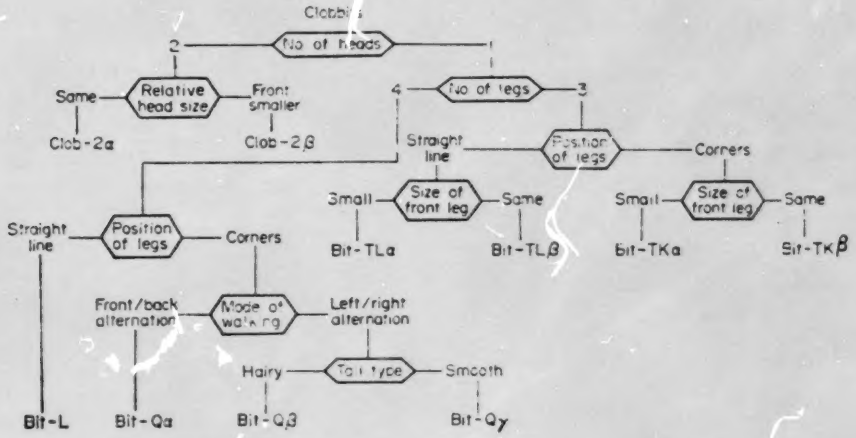


Figure 7. The Clobbits taxonomy.

The student has to work through the cards following a specific procedure (this is what is called monitored free learning). As a starting point it is assured that the student knows what it all is about, i.e. what the task goal is. This is a common feature of most of Pask's work. Often there are pre-sessions lasting for a considerable amount of time before the real experiment begins. In the procedure there are two aspect that must be noted. One is that the student subsequently has to state his aim, that is what he intends to learn about. Secondly, in selecting and turning over cards the student must state his reasons for doing so. He must also state his intention under one of the following headings:

a. Exploratory search: an intention to explore the categories in terms of the type of information available, without attending to specific content.

b. General search: An intention to examine the content of cards with no commitment to it being relevant.

c. Request for a particular item of information. Here the student is asking a complex question of the form "What are the several features that distinguish X animals from Y animals?" or "How many legs and how many heads has an X animal, and how is this related to the code name?"

d. Testing a simple hypothesis. Here the student wishes to check a particular belief, for example, that "2" in a suffix refers to the number of heads.

e. Testing a complex hypothesis. Here the student wishes to check a complex belief, for example, that an X animal has one head, three legs and a bushy tail (cf Pask, 1976, p 45 ff).

The fact that the subjects have to state their intentions in predetermined categories should, at least partly, be seen as a consequence of a demand within the theory for a common conversational language L (see above). In this case the language is not very restricted, but in other cases, when using systems operating with a computer, the categories of this language are far more developed.

When having worked through the materials for ½ - 1 1/2 hour it is maintained that subjects are 'stable' with respect to the strategy they use. Learning is then interupted and followed by 'techback' and an ordinary performance test. As can be inferred from the term teachback is a procedure where the student has to act as a teacher, instructing the experimenter under the assumption that the latter is a novice with respect to the Clobbits taxonomy.

The cards selected and turned over and the reason stated are recorded and from these subjects are classified as either serialists or holists.

"Serialists learn, remember and recapitulate a body of information in terms of string-like cognitive events where items are related by simple data links: by low-order relations" (Pask and Scott, 1972, p 219).

"Holists, on the other hand, learn, remember and recapitulate as a whole: formally, in terms of higher-order relations" (ibid, p 218).

There are also two subcategorise of holists' called <u>irredundant</u> and <u>redundant</u> holists, respectively. Both types of holists image an entire system of facts or principles. An irredundant holists' image is richly interconnected, but it contains only relevant and essential constituents. A redundant holists' image, on the other hand, is 'overspecified' and contains irrelevant material. The salient facts and principles are embedded in a network of redundant items. This redundant material is derived from data (remember the redundance of the card classes) and/or from personal experience. This distinction between redundant and irredundant holists is probably of great psychological importance as an expression of some subjects' tendency to personalize their learning and understanding. It must also be stressed that a priori there is nothing said about the relative merits of one strategy or the other.

What are then the more specific criteria distinguishing serialists from holists (and for that matter redundant from irredundant holists)? The strategy is defined through the ways that subjects:

- direct attention to different parts of the learning task
- ask specific questions
- assimilate material by specific types of 'self explanation'
- pose specific types of hypotheses

Pask and Scott (1972, p 219 f) distinguished four types of reasons actually given for posing questions, i.e. asking for cards:

A. "search the co-ordinate of the message space", i.e. to pass through a pack of cards as if thumbing over the pages of one chapter in a book.

B. "search for a datum regarding a particular object, specimen, fact, etc., named independently of the card-category co-ordinates.

C. "test a hypothesis about a simple predicate" (for example, that a specimen in Class X has more than two legs).

D. "test a hypothesis about a complex predicate" (for example, that Class X differs from Class Y in respect of leg number and mating behaviour or habitat).

A comparison with the predefined categories of intentions described above shows that the categories actually given are a, c, d and e.

A serialist differs from a holist mainly in terms of the complexity of the hypotheses he puts to test. A serialist has hypoteses of single properties, for example:

"Do Clobs have two heads?"

A holist, on the other hand, has more complex hypotheses with combined properties, for example:

"Does number of legs and position of legs distinguish Bit-L from the other bits?"

Note that what counts is only the form of the hypothesis, not what the hypothesis is about. If an account is given to what parts of the task a subject directs his attention to the following can be noted.

A serialist lists the subspecies by examining the picture cards. If successful he checks the relevance of the information by forming single-predicate hypotheses and testing these hypotheses by inspecting cards belonging to other classes of information. The classes of information attended to is 'structure of taxonomy' (names of members of subspecies and number of physical characteristics tested in order to distinguish a subspecies). A structure is thus built up in an orderly way.

An irredundant holist tries to find the overall form of the taxonomy and to locate the tests that have to be carried out. Typically he seeks information about context, physical characteristics, and subspecies codes and names. He formulates complex-predicate hypotheses which are tested by inspection of pictures.

A redundant holist scans through the cards in many or all of the classes. He bases hypotheses mostly on the subspecies' names and codes (cf Pask, 1975a, p 54 ff).

Both serialist and holist strategies are prone to some drawbacks. Holists may have a tendency to overgeneralize, trying to make the system more regular or symmetric than it actually is. Serialists may have difficulties if they fail to see what is important, for example, by trying to learn all the features of the pictures. Pask and Scott even noted that some serialists accumulated all the relevant data but failed to reconstruct the taxonomy.

In a typical experiment on taxonomy learning subjects first have to work through a material using the procedure of free learning. From this their learning strategy is determined. Next they work through a program describing another taxonomy. This taxonomy is in principle similar to the taxonomy of the Clobbits and deals with some other imaginary species, the Gandlemullers. In the experiments a match-mismatch paradigm is used. This means that serialists and holists are divided within groups, one half receiving a serialist program and the other a holist program. Both programs have a linear format and convey the same strictly relevant information, but are structured in very different ways. The serialist program is describing the taxonomy in a

sequential logical way and does not contain redundant information. The holist program, on the other hand, conveys information making 'cross-references' in the taxonomy and also contains redundant information. There are thus two match conditions (a serialist learning strategy combined with a serialist program and a holist learning strategy combined with a holist program) and two mismatch conditions (a serialist learning strategy combined with a holist program and a holist learning strategy combinded with a serialist program). Typically a mismatch of strategy and program impairs learning and the results can be rather drastic. In several experiments all subjects in the match conditions is better than the best subject in the mismatch conditions with regard to results on performance tests (cf Pask and Scott, 1972; Pask, 1976).

There are also substantial differences between serialists and holists with regard to how they 'teach back'. Two excerpts from protocols may illustrate this and also illustrate the essence of the serialist and holist strategies. The serialist (receiving a serialist program) description is sequential in a logical fashion, devoid of redundancy:

> "Zoologists have classified the Gandlemuller on the basis of physical characteristics. The three main types are Gandlers, Plongers and Gandleplongers. Gandlers have no sprongs. Plongers have two sprongs. Gandleplongers have one sprong. There are four subdivisions of Gandler; MI, MII, BI and BII. The M's have one body, the B's have two bodies. The MI and BI have a single cranial mound. The MII and BII have a double cranial mound. There is and M-plonger-a and b and B-Plongers-a and b. M's with one body and are distinguished by the type of vibratory sensor, which for M-Plonger-a is retractible. The b is fixed" (Pask and Scott, 1972, p. 246).

The account given by a holist (receiving a holist program) is quite different.

> "I am going to tell you about a funny martian animal which has been recently discovered and classified by scientists conducting surveys. They are funny slug-like things with various proturbances, some of which, differ amongst the different types. Zoologists use these differences to draw up a classification. There are other ways of telling them apart. The main alternative is a Russian scheme which uses masticator differences where the standard scheme talks about sprongs which are a kind of horny spike, used for defence against predators, notably Owzard or night vulture which is also Martian. These animals are called Gandlemullers because they churn about in the svamps near the equator and Gandle is Martian for swampmud, hence swampmudmiller...."(Pask and Scott, 1972, p. 244 f).

These descriptions are not given in a free learning situation but when learning from a program matched to the learning strategy adopted. Still they

give a very good illustration of the differences between holist and serialist strategies. Serialists are very straightforward in their description and, not least important, the order of their description almost wholly coincides with the order in which information is given in the program. In the holist description it can be noted that there is redundant information and also, that the order of information given in their description does not follow the order given in the program. As for the redundant information, this is partly given in the program and partly invented by the subjects themselves (i.e. they personalize knowledge).

Making the distinction beween matched and mismatched conditions it was mentioned that there are gross differences. On the other hand there are no differences between the strategies with respect to efficiency. Serialists and holists perform equally well. This is important to note, there is thus no claim that either strategy is better than the other. Pask´s results, however, are not well suited for any final conclusions. This is due to the fact that both serialists and holists show figures on performance test close to maximum and ceiling effects can not be excluded. The results may be interpreted in two ways. It can be argued that the outstanding results in the match conditions are due to the fact that Pask has succeded in offering the subject a teaching strategy that is based on sound psychological principles, i.e. that the theory is valid, at least in the specific context. On the other hand it can be argued that the major point is that the mismatch condition really impairs learning, which also, of course, is a validation of the theory. Both ways of reasoning may be correct.

The validity claims must however also be discussed from other points of view. The first is related to Pask´s ways of doing empirical research. Above the procedure used was described and it was noted that subjects have to ´agree´ on a contract, i.e. they must understand the problem (the aim) and also subscribe to formulate their intentions in a set of predefined categories (they have to subscribe on using a certain language L, to use Pask´s terminology). Furthermore, it can be noted that in these studies subjects are most often not randomly chosen. Subjects entering the experiments are instead chosen to represent different learning strategies. The number of subjects in the studies is also very low (In the typical experiment presented in Pask

and Scott (1972) there are in summary 16 subjects, 8 serialists and 8 holists. This amounts to the number of 4 subjects in each cell in the design.) The problem of learning a taxonomy or classificatory scheme is also rather specific even if it can be maintained that such a subject in fact is rather close to parts of curricullum in biology and chemistry, for example.

These objections do not mean that Pask´s results are invalid. On the contrary I think that his studies demonstrate the psychological significance of the proposed strategies and also demonstrate the importance of the matching of teaching and instruction to subject´s learning strategies. Questions may however be raised as to the validity of these learning strategies in, for example, ordinary school learning. According to our own studies in taxonomy learning (cf Lindström, 1983) the major problem is to come to an agreement on a common frame of reference, i.e. defining the problem and the language L. Here I think you have to ´turn the coin around´ and also examine the learning strategies used by subjects in school learning by using the theory as an ´analytic tool´ as a complement to the empirical heuristic of ´monitored free learning´. In this area there is a need for a substantial body of empirical research, before any conclusions about the validity of the holist and serialist strategies are made. It must also be added here that Pask himself recognizes these limitations and does not make any claims outside the restricted context set.

Above the serialist and holist learning strategies have been described, mainly by giving descriptions tied to an empirical context. By summary, a subject´s strategy is revealed by: a) the way he works through a material during free learning and b) the organization and content in teachback. There are also alternative methods of determining a subjects learning strategy. Pask suggests that content analyses of written essays may be possible to use. Such a method would be of great value for diagnostic purposes if proven valid and reliable.

What then is a learning strategy in Pask´s terms? Pask (1975) makes the following summary definition:

> "a learning strategy is first of all a contingent plan for selecting perfomance strategy domains (fields of attention) and secondly a

plan for building these strategies or for reparing them" (ibid, p. 263).

In this definition Pask makes an important distinction between strategies on different levels. The first part defines a strategy as a plan for directing attention to different parts of the task, to different goals and subgoals - the field of attention. This field of attention is the domain or content on which to operate with some lower level procedures - called performance strategies. If we attend to the problem of taxonomy learning, a performance strategy may be examplified by the use of some of the strategies of concept acquisition proposed by Bruner, Goodenow and Austin (1956). Other examples of performance strategies my be ´verbalizer´ and ´imager´ strategies (cf Riding and Ashmore, 1980). The major point here is the notion of compatibility of strategies on different levels, keeping in mind that a strategy always is the expression of an intentional activity.

The second part in the definition -- "a plan for building these strategies and repairing them" -- accounts for the idea that higher level procedures must have the ability to reproduce strategies on the lower level. It is not only a plan for directing attention but also for choosing and defining appropriate lower level procedures.

Conversation Theory defines procedures on two levels. A learning strategy is an expression of subjects´ performance on the higher level D(1) (the entailment structure). A performance strategy is an expression of the performance on the lower level, D(0) (the task structure). The latter may also be explicated in terms of how subjects perform on a "modelling facility". A modelling facility is the concrete experimental setting in which subjects build models, for example, the famous water jars in some of Piaget´s experiments).

One crucial point of Pask´s work on learning strategies is that the major distinction between serialist and holist strategies is theoretically derived. Pask maintains that theoretically a redundantly specified topic relation may be arrived at (or solved) in basically two ways: by the serial application of basic procedures or by the parallel application of basic procedures. The main reason for Pask to use this distinction is that these strategies are

incompatible in a specific context -- either one has to be chosed.

In this section Pask´s proposals of learning strategies has deliberately been described in terms of subjects´ learning strategies. This is mainly done in order to give a more familiar and comprehensive framework. It must be pointed out that this must not lead to the conclusion that a strategy is a characteristic of an individual. A subject may very well adopt different strategies in different contexts. Another problem is that subjects may have different competences in using different learning strategies. This will be discussed in the next chapter after having given an account of Pask´s work on learning styles.

## 3.2 Comprehension and operation learning styles.

The term learning style is for Pask expressing a more general aspect of the cognitive system. A learning strategy is tied to the operations done on a specific domain, a learning style is not tied to such a domain. To make an analogy, the idea of "figure-ground" may be used. Style may be thought of as the ´ground´, and the strategy (for example) as the ´figure´. In the context of subject matter learning Pask has defined two basic styles: Comprehension learning and operation learning.

Pask (1976) describes comprehension learning in the following way:

> "Comprehension learners pick up an overall picture of the subject matter; for example, in a taxonomy the number of classes, the type and number of items in a class, redundancies in the taxonomic scheme, relations between the distinguished classes, a clear picture of where the information about items can be discovered. These learners may or may not be able to perform the operations required to use the subject information (here, to classify specimens)"(ibid, p 84f).

Operation learning, on the other hand, is described as follows:

> "..operation learners pick up rules, methods and details but are often unaware of how they fit together, still less of why they do fit together. Typically, operation learners have at most a sparse mental picture of the material. Their recall of the way the originally

learned (insofar as they learned at all) is guided by arbitrary numering schemes or accidental features of the tutorial information frames"(ibid, p 85).

These descriptions offer rather good definitions. They also conform to our daily-life experiences of differences in learning. It may however be noted that the styles are described in terms of characteristics of individuals, rather than characteristics of some cognitive system. There is in itself no objection to this. Even if Conversation Theory is a theory of cognition in a general sense, this cognition may also be present in humans. Another thing may, however, be observed. The description is actually a description of the consequences or outcome of some learning style, rather than a description of the characteristics of the styles per se. There is nothing peculiar about this, especially not within Conversation Theory, but in order to get a better understanding of Pask's conception of learning styles the constituents of comprehension and operation learning styles must be discussed.

Comprehension and operation learning styles are anchored in two basic distinctions. The first is a distinction between description building and procedure building processes. The second is a distinction between a local and a global orientation.

Returning to the general model given in section 2, both description building and procedure building are procedures on the higher level. Description building accounts for the fact that a concept must be described in terms of other descriptions (of other concepts). That is, in learning a concept you must be able to generate a description of the new one in terms of descriptions of the old ones. Procedure building accounts for the fact that in order to arrive at a new concept you must develop procedures that operate on the descriptions built, out of old procedures. To provide an analogy, you may think of an artist painting a picture. He must first appreciate what he is going to paint, or have some kind of sketch (description building). In order to realize the picture he must also be able to work out the details, how to actually paint the picture (procedure building). Apart from giving an account of the processes, the analogy also embodies the idea that procedure building operations takes the description, resulting from the discription building operation, as one of its arguments.

As for the global/local distinction this is related to "span of attention". A global orientation will then mean an attention to many topics in a domain and a local orientation means a narrow focus.

Pask's idea is that description building and procedure building operations may be more or less efficiently used in the system. Even if both kinds of operations are needed either may be more or less efficient. There may thus be a bias towards description building or procedure building operations. If this idea is combined with that of the global local distinction the following scheme is arrived at (after Pask, 1976, p 103).

| | DB/PB | DB bias | PB bias |
|---|---|---|---|
| Global | Versatile or Comprehension Learning | Comprehension Learning | Operation Learning |
| Local | Versatile or Operation Learning | Operation Learning | Operation Learning |

This scheme needs some clarification. First of all, the distinction between comprehension learning and operation learning is not dichotomous. Secondly, comprehension learning necessarily implies a global orientation. This is related to another important aspect, namely the use of analogies. All learning involves some appreciation of analogy relations (in Pask's definition some morphism. The simplest one is an isomorphism or one-to-one correspondance.) Pask argues that comprehension learning must involve valid analogy relations and operation learning may do so. One aspect of this is that comprehension learning often includes analogies drawn between, for example, formal concepts and real life events.

If there is no bias towards either description building or procedure building a subject may be either Versatile, Comprehension or Operation

learner, globality or locality distinguishing between the latter. The versatility construct, however, introduces another quality. It is an expression for a general ability to use both description building and procedure building and change procedures, depending on the context.

In order to further explicate the meaning of the learning styles, and also for it´s own sake, it is fruitful to examine the ´pathologies´ of comprehension learning and operation learning, respectively. These pathologies are termed Globetrotting and Improvidence. (Pask is not clear in his writings on this point. He describes Globetrotting as Comprehension learning in the absence of Operation learning and Improvidence as the reverse. Globetrotting, however, seems to mean a severe bias towards description building and Improvidence a severe bias towards procedure building.)

Globetrotters are unsuccessful comprehension learners. They:

> "are able to describe a topic relation and thereby to derive its description from others, but they fail bacause they are unable to complete the derivation and build a concept. As a result, they are also unable to explain whatever is described, they comprehend only in the sense of making descriptions. They do not augment their comprehension by the operations needed to form a concept" (Pask, 1978, p 99).

Included in this is also a tendency to see analogies everywhere. These analogies are often very superficial (they remain on a descriptive level) and may even be tautologous. When asked "Why" there is an analogy, subjects can´t give an answer.

Improvidence, on the other hand, is the term for the less successful operation learner.

> "As a rule they are quite able to explain anything they know, using partial complementation (´there is a missing link´..). Their stumbling block is inability to describe analogical relations between distinct entities... the students are adept at concept building operations but are embarrassed by inability to comprehend descriptions" (Pask, 1976, p 99).

An improvident learner thus fails to use valid analogies or use a common principle. They may for example relearn the same formal relation in different contexts.

What is then the relation between learning strategies and learning styles? Pask argues that it is possible to dissect style into two parts. On one hand there is a disposition or desire to use a certain learning strategy. On the other hand, style is an expression for a ´competence profile´ (cf Pask, 1976, p 122ff). Competence may be related to the existence of appropriate procedures in the cognitive system, but it may also be a property of the processor in which this cognitive system is running. Pask proposes that the ´global or local´ orientation is such a property. Style is then an expression for a general tendency to adopt a certain learning strategy. Comprehension learning is a tendency to act like a holist. Operation learning is a tendency to act like a serialist. Versatility, on the contrary, is an ability to choose the appropriate strategy or to change strategy according to circumstances.

## 4 Concluding remarks

In educational research Conversation Theory may serve basically three purposes. First of all, hypotheses about learning and teaching can be derived and empirically tested. In the preceeding section examples of this were presented in some of Pask´s work on learning strategies and learning styles. Secondly, Conversation Theory offers a methodology for studying phenomena of learning and teaching (as well as problem solving and thinking in general). This has also (more or less explicitly) been touched upon above. Thirdly, the theory provides an analytic tool in research on learning and teaching.

Used as an analytic tool, Conversation Theory provides a general framework, within which to study phenomena of learning and teaching. It defines learning and teaching as part and parcel of the same process (the conversation). When there is learning there is teaching and when there is teaching there is learning. This means that you may describe learning and teaching in compatible (or even the same) terms. Conversation Theory may here give a

general theoretical framework, within which to integrate theories of learning and teaching. Theoretical and empirical work has to show how valid such a claim is.

Conversation Theory is theoretically and methodologically a normative theory. This is substantiated, for example, in establishing a "contract" between experimenter and subject. This contract is essentially an agreement of a definition of a common frame of reference within which the conversation takes place - or put in more general terms, an agreement of the meaning to give to a situation. In his empirical work Pask is mainly prescriptive on this point. (Compare the discussion above in relation to empirical research on learning strategies). When Conversation Theory is used the other way around - as an analytic tool - it seems logical to try to establish which is the frame of reference, within which to understand a subject´s acting. A brief example will explicate this. When analyzing transcripts of a subjects accounts of what he or she has learned (or for that matter ask a person about his learning) you must ask the following kind of question in order to make a subjects utterances intelligible and interpretable: What is the meaning given to the situation by this person, which meaning leads him to tell certain things?

Conversation Theory is then also incorporating an idea of subjectivism that comes close to Smedslund´s (1970) idea of "the circularity of logic and understanding". Smedslund meant that when studying man we have to take either understanding or logicality for granted. To draw conclusions about logicality we have to take understanding for granted, and vice versa. Smedslund´s contention was that we have to take logicality for granted, as the very basis of the notion of man. Rommetveit (1972) has stressed a similar point in his theory of "message structure". The conclusion is that it is necessary to look for the meaning given to the situation by our subjects, or, put in other words, to look for the premisses the subjects themselves set up for their activities (cf Broudy, 1977).

The account of Pask´s work given above is only aimed at giving an understanding of some of his essential ideas, mainly related to his work on learning strategies and learning styles. There are many issues not even touched upon. Among these are ideas of ´subject matter representations´,

´learning to learn´ and an elaborate set of experimental procedures, not to mention the epistemological aspects of the theory.

Neither has Pask´s extensive use of computers in his empirical work been discussed. The main reason for avoiding this is that this feature is very important from a theoretical point of view. Pask´s provision of computer programs may, however, contribute to the development of the computer as a research tool, where the computer is used as a modelling facility for the explication of conversational transactions.

It seems obvious that Pask´s ideas are worth exploring: he is offering a general framwork for the study of learning and teaching; his empirical research on learning strategies and learning styles shows interesting results; some of his theoretical ideas are rather intriguing. As for the latter the idea of an analytical separation of the cognitive organization from the human mind is most interesting. It must, however, be recognized that Pask above all is a ´model builder´. In relation to his work on learning strategies and learning styles this means that his concepts and distinctions are mainly theoretically derived, even though empirically supported in his own work. What is most seriously needed in order to make any judgements about the value of this part of the work is further empirical research.

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